The ARC is etched through. A trench is etched into the dielectric layer with a dielectric to photoresist etch selectivity between 1:1 and 2:1.

In another manifestation of the invention a method for etching a trench to a trench depth in a dielectric layer over a substrate is provided. An ARC is applied on the dielectric layer. A sensitive photoresist mask is formed on the ARC, with a thickness between about 2000 Å and 4000 Å. The ARC is etched through. A trench is etched into the dielectric layer with a clean etch.

In another manifestation of the invention an apparatus for etching a feature in a dielectric layer is provided. A plasma processing chamber is provided. The plasma processing chamber comprises a chamber wall forming a plasma processing chamber enclosure, a substrate support for supporting a substrate within the plasma processing chamber enclosure, a pressure regulator for regulating the pressure in the plasma processing chamber enclosure, an electrode placed opposite from and spaced apart from the substrate support, a heater connected to the electrode for heating the electrode, a gas inlet for providing gas into the plasma processing chamber enclosure, and a gas outlet for exhausting gas from the plasma processing chamber enclosure. A gas source is in fluid connection with the gas inlet. A controller is controllably connected to at least one of the gas source the electrode, the heater, the pressure regulator, the gas inlet, and the gas outlet.

These and other features of the present invention will be described in more details below in the detailed description of the invention and in conjunction with the following figures.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements and in which:

FIG.'s 1A and 1B are cross sectional views of a trench etched into a dielectric layer according to the prior art.

FIG. 2 is a flow chart of a process used in an embodiment of the invention.

FIG.'s 3A-3C are cross-sectional views of a trench etched according to an embodiment of the invention.

FIG.'s 4A-B are schematic illustrations of top views of etched trenches.

FIG. 5 is a schematic view of a process chamber that may be used in a preferred embodiment of the invention.

FIG.'s 6A and 6B illustrate a computer system, which is suitable for implementing a controller.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be described in detail with reference to a few preferred embodiments thereof as illustrated in the accompanying drawings. In the following description, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be apparent, however, to one skilled in the art, that the present invention may be practiced without some or all of these specific details. In other instances, well known process steps and/or structures have not been described in detail in order to not unnecessarily obscure the present invention.

FIG. 2 is a flow chart of a process of forming a trench in a dielectric according to the invention. An ARC (Anti-Reflective Coating) is formed on a dielectric layer (step 204). FIG. 3A is an illustration of a cross-sectional view of a dielectric layer 308 over a substrate 304. An ARC 310 is provided on the dielectric layer 308, as shown. The ARC 310 may be an organic or inorganic ARC. The dielectric layer is a trench dielectric layer, in which a dual damascene trench is etched. Such a dielectric layer is not a hard mask layer.

A sensitive trench photoresist mask 312 is formed on the ARC 310 (step 208). A sensitive trench photoresist mask is a thin mask. In a preferred embodiment, the thin sensitive trench photoresist mask is between 2000 Å and 4000 Å. In a more